

A NEW SPECIES OF ANOPHELES FROM QUEENSLAND AND NOTES ON RELATED SPECIES (DIPTERA: CULICIDAE).

By ELIZABETH N. MARKS, National Mosquito Control Committee,
Department of Entomology, University of Queensland.

(With twelve Text-figures.)

(Received 29th December, 1955; issued separately, 13th August, 1956.)

Edwards (1932) divided the species of the subgenus *Anopheles* into groups and series. Three Australian species fall within his Group A, *Anopheles* series, viz. *A. atratipes* Skuse, *A. stigmaticus* Skuse, and *A. powelli* Lee. The last two together with *A. colledgei* n.sp. and three forms of undetermined status (one of them *A. corethroides* Theobald), form a complex of closely related species (a subgroup in the sense of Knight and Marks, 1952). All known members of this complex occur in Queensland, and the following notes give distribution records for the State and indicate the gaps in our knowledge of species. The adults are small brown anophelines, superficially *Culex*-like, with uniformly dark scaled wings, and where known, the pupae have seta 7 of abdominal segments VI and VII about half the length of the segment, and the larvae have head seta 3 single and antennal seta 1 short, arising fairly close to the base of antenna.

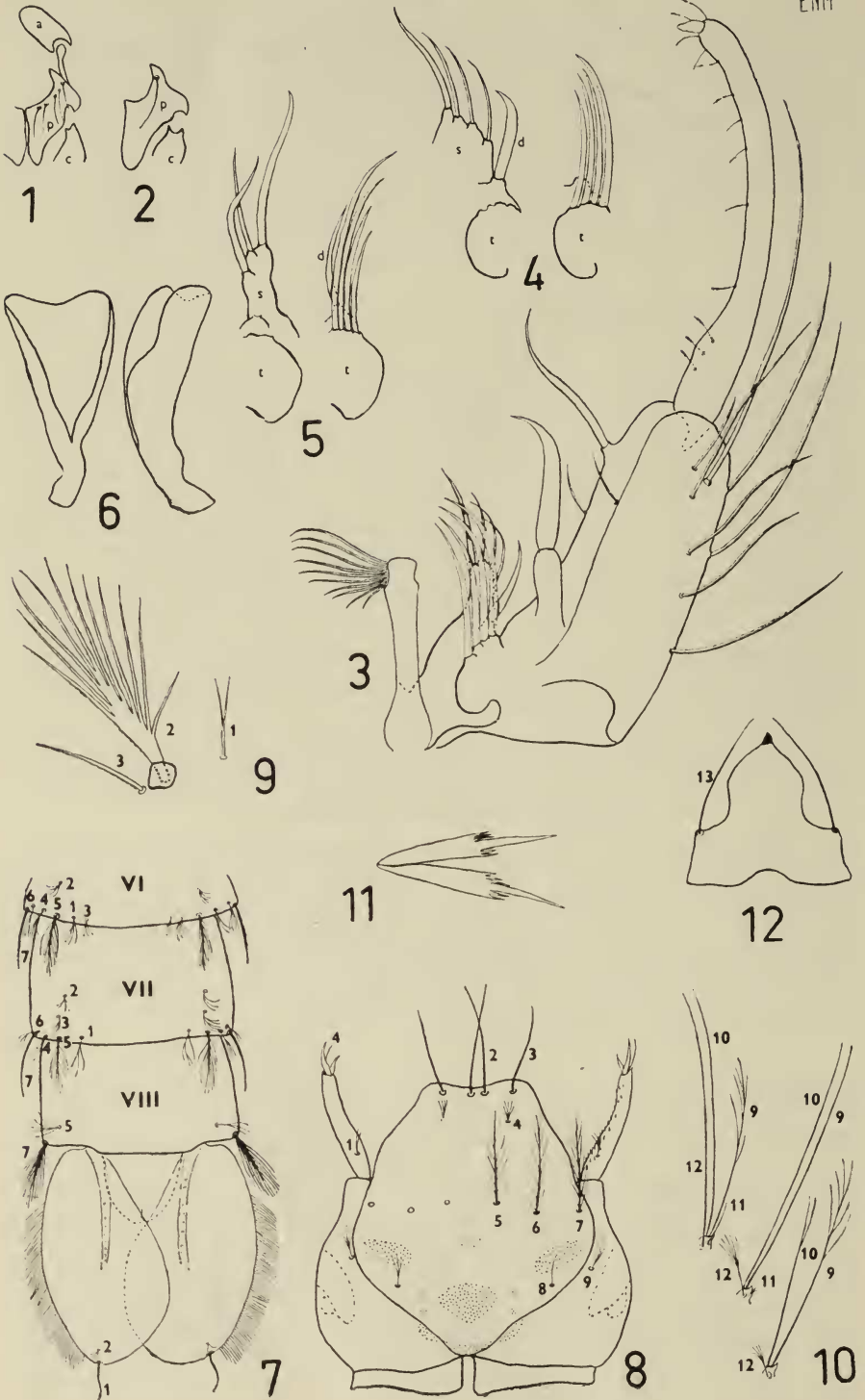
The terminology used in the description of the pupa is that of Belkin (1953), and in the description of the larva that of Belkin (1950).

ANOPHELES (ANOPHELES) COLLEDGEI n.sp.

DISTINCTIVE CHARACTERS: Adult with basal 0.7–0.8 of hind femur entirely pale; sternites III, IV, and VII very pale, contrasting sharply with remainder; 3–6 propleural bristles. Pupa with abdominal segments III, IV, and VII distinctly paler than the rest, paddle seta 2, 2–3 branched. Larva with abdominal segments III, IV, and VII distinctly paler than the rest; prothoracic seta 1 short, 1–4 branched; valve seta 13 very long.

FEMALE: Wing length 2.6–3.0 mm. (2.7 mm. in holotype).

Head: Integument light to medium brown with a small rounded black patch laterally on eye margin (not very obvious except in fresh specimens), clothed with very long, narrow, pale golden, upright forked scales medially, with some long fine dark bristles laterally and along eye margin, and with a group of fairly long pale bristles and frequently a couple of elongate narrow scales at vertex. Eyes purplish. Tori pale or medium brown, first flagellar segment of antenna 1.1–1.5 times length of second, its basal two-thirds pale; remaining segments dark; verticillate hairs black. Clypeus black. Palps black scaled, about equal in length (0.9–1.0) to proboscis (excluding labella), the fourth segment about 2.5 times as long as the fifth. Proboscis black scaled, about equal in length (1.0–1.1) to fore-femur and 0.8–0.9 length of fore-tibia. Labella dark brown.



Thorax: Integument patchy, dark brown and pale cream. Neck sclerites dark. Scutum dark, except for a pale area on fossae or outer half of fossae which may extend forward below the anterior promontory, rarely forming a continuous border; anteriorly there may be a short medial pale streak just extending on to dorsal surface of scutum. Scutellum dark above medially, paler laterally and beneath. Metapostnotum medium brown, paler laterally. Pleuron with two ill-defined dark lateral stripes, the rest pale. Anterior pronotum, upper part of posterior pronotum, post-spiracular area, upper third of sternopleuron and upper fourth of mesepimeron dark (paratergite pale); propleuron, upper half of fore-coxa, lower third of sternopleuron, meron and lower fourth of mesepimeron dark. Scutum with numerous short golden acrostichal and dorsocentral bristles, others on fossae and above wingroots; long prescutellar and scutellar bristles dark brown. Anterior pronotum with some golden bristles; propleuron (Fig. 1) with a row of 3-5 dark bristles (one specimen only with 2 on one side); 1-2 pale spiracular, 1 strong upper sternopleural, 2-4 short lower sternopleural, 1-3 prealar and 3-6 upper mesepimeral bristles.

Legs: Fore-coxa dark on upper half, pale below, trochanter dark. Mid-coxa dark on upper angle, rest pale, trochanter pale; hind-coxa and trochanter pale. Fore- and mid-femora dark scaled except for a narrow pale basal ring and a pale streak posteroventrally which may not reach to base and apex; basal 0.7-0.8 of hind-femur entirely pale scaled, remainder dark. Tibiae and tarsi dark scaled.

Wings: Cell R_2 0.7-1.0 length of its stem, cell M_1 0.4-0.6 length of its stem, their bases usually level, but one or other may be very slightly proximal; r-m 0.5-1.0 its own length distal to i-r and base of M_{3+4} , or almost in line with base of M_{3+4} ; there may be a very slight darkening of the wing membrane near the tip of Sc. Haltere with pale stem and black scaled knob.

Abdomen: Bare of scales, clothed with numerous brown hairs. Tergites all very dark, or III, IV, and VII slightly paler, at least along lateral margins. Sternites dark except III, IV, and VII which are very pale and contrast sharply with the rest.

MALE: Resembles the female, except as follows: Wing length 2.3-2.8 mm. (2.7 mm. in allotype). Tori large, dark brown above, paler below; the more basal flagellar segments of antenna pale, apical two darker; verticillate hairs long, dark. Palps 0.9-1.0 length of proboscis (excluding labella), the two apical segments swollen, forming a club; proboscis 1.3-1.5 times length of fore-femur, 1.1-1.2 times length of fore-tibia. 4-6 propleural, 1-2 lower sternopleural, 1-2 prealar and 2-5 upper mesepimeral bristles. Cell R_2 0.7-0.8 length of its stem.

TEXT FIGURES 1-12.

Fig. 1, *Anopheles colledgei* n. sp., anterior view of propleuron, *p*, showing propleural bristles; *a*, anterior pronotum; *c*, fore-coxa. Fig. 2, *A. corethroides* Theo., ditto. Figs. 3 and 4, *A. colledgei* n. sp., male terminalia. 3, tergal view of right coxite, style, harpago and of phallosome; 4, inner lateral view of right harpago; *s*, sternal lobe; *t*, tergal lobe; *d*, distal seta of tergal lobe. Fig. 5, *A. corethroides* Theo. (topotypical specimen), tergal view of left harpago, lettering as in Fig. 4. Figs. 6-12, *A. colledgei* n. sp. 6 and 7, pupa; 6, two views of trumpet; 7, dorsal view of terminal abdominal segments. 8-12, larva; 8, dorsal view of head; 9, prothoracic setae 1-3; 10, pro-, meso- and metathoracic pleural groups of setae; 11, leaflets from seta 1, abdominal segment IV; 12, median plate of scoop, with seta 13.

Terminalia (Figs. 3 and 4): Coxite cylindrical, about 2.5 times as long as broad, with scattered long setae laterally and sternally; subapical spine represented by a stout seta on inner aspect sternally; a single stout parabasal spine arising from an elongate base. Style 1.1-1.2 length of coxite with small blunt terminal appendage and 6-13 scattered fine setae along its inner aspect and at tip. Sternal (ventral) lobe of harpago elongate with a stout terminal seta and 3 (rarely 2) more slender setae proximal to it; tergal (dorsal) lobe with 5-6 broadened setae, 4 in a close set row, and one (rarely 2) shorter and broader arising distally between them and the sternal lobe. Phallosome with about 10 pairs of long, slender, smooth leaflets, those towards apex longest. Lobes of tergite IX widely separated, slightly convex, with numerous short setae.

Descriptions based on holotype and 15 paratype females, allotype and 19 paratype males. An additional female (no locality data other than N. Qld.) has wing length 3.3 mm.

PUPA: Distinctly striped; abdomen dark except segments III, IV and VII which are contrastingly pale. Trumpet (Fig. 6) broad, triangular. Abdomen (Fig. 7). Segment VI - seta 1 fine, 3-5 branched, about half length of seta 5; seta 2 fine, 2-7 branched; seta 3 fine, 3-4 branched; seta 4 fine, 2-4 branched; seta 5 stout, plumose, half length of segment; seta 6 fine, 3-6 branched; seta 7 a stout spine, usually frayed near tip, half length of segment. Segment VII - seta 1 fine, 2-5 branched, about half length of seta 5; seta 2 fine, 3-5 branched; seta 3 fine, 3-6 branched; seta 4 fine, 3-4 branched; seta 5 stout, plumose, half length of segment; seta 6 fine, 2-4 branched; seta 7 a stout spine, sometimes frayed near tip, half length of segment. Segment VIII - seta 5 fine, 2-5 branched; seta 7 plumose, with thickened shaft. Paddles with long fringe; seta 1 stout, single, simple; seta 2 small, fine, 2-3 branched.

Described from six pupal skins correlated with the holotype and five paratypes. Seta 1 on VI and VII and paddle seta 2 appear to be shorter and with fewer branches than in *A. stigmaticus* (cf. Mackerras, 1927, fig. 3b).

LARVA: Length 3.5-4.5 mm. Distinctly striped; body dark grey except pro- and mesothorax and abdominal segments III, IV and VII, which are contrastingly pale; head and saddle pale brown. Head (Fig. 8) with dark spots on integument as illustrated, setae 2 arising close together, long, stout, single, simple, crossed; seta 3 stout, single, simple, about 0.7 length of 2; seta 4 arising behind 3, short, 2-6 branched; setae 5, 6 and 7 plumose, not reaching front of head; seta 8, 1-4 branched; seta 9, 3-6 branched. Antenna with fine spicules along its inner side, and shorter ones ventrally; seta 1 short, 2-5 branched, arising dorsally at about 0.2 from base; seta 4 single.

Thorax (Figs. 9, 10): Prothorax—seta 1 short, fine, 1-4 branched (usually 2-3); seta 2 with flattened stem, 7-15 branched, arising from a sclerotised base; seta 3 single or rarely bifid; seta 6 single, arising from same sclerotised base as seta 5; seta 9 long, sparsely plumose (5-8 branched); seta 10 long, single, simple; seta 11 fairly short, single or rarely bifid or trifid at tip; seta 12 long, single, simple. Mesothorax—setae 9 and 10 long, single, simple; seta 11 very short, 1-3 branched;

seta 12 fairly short, 3-6 branched. Metathorax with a small broad medial plate dorsally; seta 1 palmate, with 14-18 slender, tapering leaflets; seta 9 long, sparsely plumose (5-9 branched); seta 10 long, 2-4 branched (usually 2) near tip; seta 12 fairly short, 3-6 branched.

Abdomen: Segments I-VII with an anterior, short, broad tergal plate, behind which, on III-VII, is a single small elongate plate, sometimes also present on II; one specimen appears to have small paired plates behind the anterior plate on I; on segment VIII the tergal plate is surrounded by secondary sclerotisation almost covering the dorsal surface of the segment. Seta 1 on segment I palmate with 5-8 very slender leaflets; on segments II-VII palmate with about 25 leaflets (Fig. 11), usually frayed at about 0.6 length, with a distinct filament, but occasionally tapering with little indication of fraying. Pecten of 15-18 spines, those in the middle shorter than upper and lower, but uppermost spine often very short. Median plate (Fig. 12) broadened posteriorly, seta 13 long, single (as long as width of plate where it arises). Anal segment - saddle with fine spicules; seta 1, 2-4 branched near tip; seta 4 (ventral brush) of 16 plumose hairs.

Described from 6 pelts associated with holotype and paratypes, and 14 paratype larvae. Two larvae from Helenvale agree closely, except that one has metathoracic seta 10 single on one side and pecten of 14 spines.

Types: Holotype female (No. P.755), Rex Creek, Mossman, N. Qld., (2-7-1946, E. N. Marks) with correlated larval and pupal skins; allotype male, 15 female, 19 male paratypes and 26 morphotype larvae, same data as holotype; 2 morphotype larvae from same locality. 26-6-1946. The paratypes include one male (No. P.756) with correlated pupal skin, and a group of 3 females and 2 males (No. P.753) with 5 larval and 4 pupal skins not individually correlated. In addition, there are a considerable number of toptypical larvae and pupal skins.

Holotype, allotype and paratypes in University of Queensland collection, except one male, one female and two larval paratypes in each of the following collections: British Museum (Natural History); U. S. National Museum, Washington; C.S.I.R.O. Division of Entomology, Canberra; Queensland Museum, Brisbane; School of Public Health and Tropical Medicine, Sydney; Macleay Museum, Sydney; National Museum of Victoria, Melbourne.

This species is named after W. R. Colledge, an early Queensland student of mosquitoes who published the first paper (Colledge, 1901) on the immature stages and biology of Australian anophelines.

BIOLOGY: At the type locality the clear, fresh, running creek issued from rain forest and flowed for about 500 yards through an overgrown cleared patch. The creek had rocky edges, a sandy bottom, and was full of granite boulders, with green algae fringing the rocks; the site was fairly sunlit. Large numbers of anophelines were found among the algae and along the edges of boulders in slight backwaters. Both *A. colledgei* and *A. stigmaticus* (probably the northern brown form) were present, also *Culex squamosus* (Taylor) and *C. vicinus* (Taylor). At Daintree, larvae of *A. colledgei* were scarce in a deeply shaded, fast flowing, small stream in rain forest; this water was about 6 in. deep, clear and fresh with earth and rock edge, some fallen leaves and tree

roots. At Helenvale, larvae of *A. colledgei* were scarce in Nungunby Creek, a clear, fresh, running creek shaded by overhanging trees and with fallen leaves and some algae at the edges. Associated species were *A. stigmaticus* (probably the northern brown form) and *A. annulipes* Walker.

A larva from Mossman had anopheline larval remains in its gut, but this may have been due to overcrowding of the larvae after collection.

It is almost certain that *A. colledgei* is the same as the banded form of *A. stigmaticus* reported by Lee and Woodhill (1944, p. 84, footnote) from Cairns. These authors quote observations by Roberts on differences in phototropic reactions between this banded form and the plain form collected with it. No similar experiments were made with larvae from Mossman, and none of Roberts' specimens has been examined.

DISTRIBUTION: Mossman (26-6-1946, 2-7-1946), Daintree (16-6-1952), Helenvale, about 15m. S. of Cooktown (17-7-1952), all collected by E. N. Marks.

ANOPHELES (ANOPHELES) STIGMATICUS Skuse.

Anopheles stigmaticus Skuse, 1889, Proc. Linn. Soc. N.S.W., (2) 3, 1759. Type locality: Blue Mountains, N.S.W. Type male and female in Macleay Museum, University of Sydney.

Anopheles corethroides Theobald, 1907, Monogr. Culicidae 4. 35. Type locality: Burpengary, Qld. Type male and female in British Museum (Nat. Hist.).

Among specimens from Queensland, which have been identified as *stigmaticus*, four distinct forms can be recognised, viz. Theobald's *corethroides*, a northern brown form, a southern brown form and a southern striped form. The last two range from south Queensland to Victoria and current studies by N. V. Dobrotworsky should decide which of them is the type form. The status of these forms is still undetermined and the purpose here is to indicate their distribution and distinctive characters so that further records may be obtained.

SOUTHERN BROWN FORM.

DISTINCTIVE CHARACTERS: Adults with basal 0.7-0.8 of hind-femur entirely pale; sternites uniformly brown; usually only one propleural bristle. Pupa with abdomen uniformly brown. Larva uniformly brown; prothoracic seta 1 with not less than 6 branches, shaft not flattened; valve seta 13 very long.

DESCRIPTIVE NOTES (based on 8 females and 7 males from various localities from Eungella Range to Sydney district): Wing length, females 3.3-3.7 mm., males 2.7-3.7 mm.; bristles on at least anterior half of scutum golden; propleuron with a single bristle (two close together on one side in one male from Brisbane); cell R_2 1.0-1.2 times its stem in females, 0.9-1.1 in males, cell M_1 0.6-0.8 times its stem; knob of haltere partly or entirely pale scaled. Male terminalia closely resembling those of *A. colledgei*.

BIOLOGY: The larvae are usually found in rock pools or running creeks with clear fresh water and partly or fully shaded. They have also been collected from spring fed pools and a muddy pool in a wheel-rut in rainforest; rock pools containing suspended clay; temporary

rain-filled pools in shaded gullies; an old oil drum in a swamp, fringed by rain forest (the water surface with thick duckweed, the bottom of rotting leaves); a cattle watering place shaded by grass in a gully; and once in fallen palm fronds close to a spring-fed pool where they were collected on numerous occasions. The breeding places may be located in rain forest or eucalypt forest, from low altitudes up to 3000 ft. Fallen leaves and sticks, tree roots, trailing grass, green algae or water-weeds may furnish shelter for the larvae; occasionally the water contains iron bacteria.

The larvae have been found in association with the following species: *A. stigmaticus* southern striped form; *A. annulipes*; *Uranotaenia pygmaea* Theo; *Aedes queenslandis* (Strickland), most frequently; *Aedes notoscriptus* Skuse, in rock pools and palm fronds; *Aedes palmarum* Edwards, in palm fronds; *Aedes alboannulatus* (Macquart), *Aedes rubrithorax* (Macquart), *Aedes alboscuteclatus* (Theo.), in temporary pools; *Culex basicinctus* Edwards, in sites with green algae; *Culex fergusonii* (Taylor) in an oil drum in a swamp at Binna Burra; *Culex pseudomelanoconia* Theo.; *Culex cylindricus* Theo.; *Culex pipiens australicus* Dobrotworsky and Drummond; *Culex (Lutzia) halifaxi* (Theo.).

Larvae sometimes have anopheline larval remains in the gut. The pupal period occupies about two days in summer. No adults have been taken biting in nature, but a bred female from Camp Mountain fed on a finger until it passed blood.

DISTRIBUTION: The following records, principally of larval collections, have been checked by examination of adults from each locality: Eungella Range (20-9-1947, E. N. Marks); Wengen Creek, Bunya Mts. (20-9-1944, J. L. Wassell); Mt. Glorious (4, 9, 11, 12-1943, 2, 4-1944, 2-1945, 3-1955, J. L. Wassell, E. N. Marks); Ashgrove (9-1943, 3-1945); Mt. Tamborine (9-3-1952, Mackerras).

The following records are of larval collections; adults were bred from a number of them, but are no longer available for checking: Carnarvon Range (27-5-1954, F. A. Perkins); Jimna (10-10-1948, J. L. Wassell); Upper Cedar Creek (14-9-1943, 9-11-1954, E. N. Marks); Mt. Nebo (13-2-1945, J. L. Wassell); Highvale (4, 6, 7, 8-1943, J. L. Wassell); Samford (4, 6, 11-1943); Camp Mountain (6, 9, 10-1943, 11-1951, 9, 10-1952, 3-1955, E. N. Marks); Binna Burra, Lamington National Park (11-1943, 5-1944, F. A. Perkins and E. N. Marks); Mt. Barney (14-6-1947, E. N. Marks); Mt. Ballow (4-1953, E. R. B. Marks); Mt. Clunie (4-1953, E. N. Marks).

A. stigmaticus larvae were collected in the following suburbs of Brisbane during the malaria survey by the Brisbane City Council: Toowong (7-1946, Toowong Creek); Bardou (7-1946, Ithaca Creek, East Ithaca Creek); St. John's Wood (7-1946, Enoggera Creek); Holland Park (9-1946); Aspley (4, 7-1947); Bald Hills (7-1947, Albany Creek); Zillmere (5, 6-1947, Little Cabbage Tree Creek); Bracken Ridge (7-1947, Cabbage Tree Creek). From the nature of these localities, the first four are almost certain to have been breeding places of the southern brown form, but the last four may have been of either that or *corethroides*.

The foregoing records are all from localities within about 100 miles of Brisbane, except Carnarvon Range, 350 miles north-west of Brisbane, and Eungella Range, 60 miles west of Mackay. It is possible that some of the larval records cited under the northern brown form should refer to the southern brown form. Specimens of the latter have been examined from Taronga and from National Park, near Sydney, N.S.W. (4-1944, E. N. Marks), and it occurs also in Victoria (Dobrotworsky, personal communication).

NORTHERN BROWN FORM.

DISTINCTIVE CHARACTERS: Adults closely resemble, and larvae at present cannot be separated from the southern brown form, but male terminalia are distinctive. Only two shrunk males are available, and these differ from the southern brown form as follows: Wing length 2.3-2.4 mm.; scutal bristles all brown (propleural bristles obscured by shrinkage); cell R_2 1.0-1.2 length of its stem, cell M_1 0.4-0.5 length of its stem; halteres with dark scaled knob; sternal lobe of harpago with 3 slender setae, the distal one slightly longer but not distinctly stouter, as it is in the other forms; tergal lobe of harpago with only 3 rather slender flattened setae, a row of 2 (4 in other forms) and a third arising between these and the sternal lobe; phallosome with about 12 leaflets extending almost half way to its base, the distal leaflet broad and frayed along its inner edge.

BIOLOGY: At Kuranda, larvae were sheltering among fallen leaves and sticks in backwaters of a small, clear, fresh, flowing creek in a rocky gully in rain forest. At Cairns larvae were collected from rock pools in a mountain stream.

DISTRIBUTION: Kuranda (22-6-1946, E. N. Marks); Cairns (6-11-1944, R. L. Lehfeldt).

The following records are for larvae only. It is not known whether the southern brown form of *stigmaticus* also occurs in north Queensland, and these records may refer to either the northern or the southern brown forms. Helenvale, Mossman (see pp. 45, 46); Kuranda (23-6-1946, with *Anopheles annulipes* in a weed-edged creek in open grassland, near rain forest, E. N. Marks); Lake Barrine (8-6-1946, with *Anopheles bancrofti* Giles and *Anopheles farauti* Laveran in shallow shaded, reedy edge of freshwater lake; 9-6-1946, with *Culex halifaxi* and *Uranotaenia* sp. in small creek containing iron bacteria flowing through red soil in rain forest, E. N. Marks and D. Dalgleish); Cairns (25-9-1942, D. O. Atherton; 6-1944, R. L. Lehfeldt). Roberts (1948) reported larvae of *A. stigmaticus* to be widespread throughout the Atherton tableland.

SOUTHERN STRIPED FORM.

DISTINCTIVE CHARACTERS: Adults with basal 0.8 of hind femur entirely pale; sternites (and to a lesser extent tergites) IV, VII and VIII very pale, contrasting sharply with remainder. Pupa with abdominal segments IV, VII and VIII distinctly paler than the rest. Larva with abdominal segments IV and VII distinctly pale and segments III, V and VI very dark, others less so; prothoracic seta 1 with not less than 6 branches, shaft not flattened; valve seta 13 short.

DESCRIPTIVE NOTES: Four males from Mt. Clunie have wing length 3.0-3.2 mm.; bristles on at least anterior half of scutum golden; 2 propleural bristles; cell R_2 1.2-1.4 times its stem, cell M_1 0.6-0.8 times its stem; knob of halteres dark scaled.

BIOLOGY: In south Queensland, the larvae have been collected only in mountainous areas at altitudes of 1500 ft. or more, from clear, fresh, leafy, spring or stream-fed earth or rock pools, in rain forest or open eucalypt forest. They are usually found in association with the southern brown form of *stigmaticus* and with *Aedes queenslandis*.

DISTRIBUTION: Mt. Glorious (13-2-1945, alt. 2000 ft. J. L. Wassell); Binna Burra, Lamington National Park (2-11-1943, F. A. Perkins and E. N. Marks); Mt. Ballow (4-4-1953, alt. about 3000 ft., E. R. B. Marks); Mt. Clunie (5-4-1953, E. N. Marks). This form occurs in Victoria (Dobrotworsky, personal communication).

CORETHROIDES.

Edwards (1924) treated *A. corethroides* Theobald as a synonym of *A. stigmaticus* Skuse on the basis of comparison of the type female and male of the former with the description of the latter. Mackerras (1927) compared specimens of the two forms, and while pointing out differences, agreed with Edwards' synonymy, but Edwards (1930), on comparison of the types of *corethroides* with a female and male of *stigmaticus* from National Park, near Sydney, which had been compared with Skuse's type by Mackerras, ranked *corethroides* as a "variety" of *stigmaticus*. Lee and Woodhill (1944) had not seen any specimens referable to *corethroides* and regarded the position as unclarified. Information now available, though insufficient to determine its correct status, supports the treatment of *corethroides* as a distinct form, and suggests that it differs ecologically from the southern brown and southern striped forms of *stigmaticus*.

I have examined the type specimens of *A. corethroides* Theobald in the British Museum (Natural History). These bear labels "Queensland, Dr. T. L. Bancroft"; the female is labelled "T.L.B., S.Q., 16/11/03,79", the male similarly, but dated 17/11/03. Theobald (1907) gave the type locality as "South Queensland". Bancroft (1908) stated that he bred his specimens from material obtained from a small well in a gully in the Burpengary scrub, and that he had also bred it from material obtained from Kedron Brook at Alderley (a suburb of Brisbane). There is no doubt that the type locality is Burpengary; in the Queensland Museum collection there is a male labelled in Bancroft's writing "Burpengary, 18/11/03,79". Its terminalia were mounted by Mackerras (*l.c.*) who examined the four other Bancroft specimens in the same collection, which are unlabelled. They comprise one male and two females of *corethroides* and one female of the southern brown form of *stigmaticus*. Bancroft (*l.c.*) did not record *stigmaticus* from Queensland but his Alderley locality resembles breeding places of the southern brown form, rather than those from which *corethroides* has been bred.

In addition to the foregoing specimens, I have examined one female from Fraser I., 2 females and one male from Caloundra, one female from Dunwich, one male from Salisbury, and four males and seven females, dated 1940 and 1944, the localities of which are unknown.

DISTINCTIVE CHARACTERS: Adult with basal 0·7 of hind-femur pale except for a dorsal dark line; sternites uniformly brown; one propleural bristle (Fig. 2). Larvae associated with adults are no longer available, but were not distinguished at the time of collection from those of the southern brown form.

Both Mackerras (1927) and Edwards (1930) noted that *corethroides* lacked the dark patch on the wing membrane which is often present in *stigmaticus*. Neither this, nor the difference noted by Edwards (*l.c.*) of pale plume scales on the apical half of wing in *stigmaticus* (all dark in *corethroides*) are constant characters in Queensland specimens of the southern brown form of *stigmaticus*.

DESCRIPTIVE NOTES: Wing length, females 2·8–3·6 mm., males 2·7–3·5 mm. Head rarely with a few elongate narrow scales present on vertex; tori dark, first flagellar segment of female antenna 1·3–1·5 length of second; palps equal in length to proboscis; proboscis 0·9–1·0 length of fore-femur in female, 1·3–1·4 in male, 0·7–0·9 length of fore-tibia in female, 1·0–1·1 in male. Scutal and scutellar bristles all brown. Dorsal dark line on hind-femur tends to be broader in males; it may be interrupted at base or before the apical dark scaled area, or distinct only on the distal half of the pale portion. Cell R_2 1·2–1·6 length of its stem in females, 1·0–1·2 in males; cell M_1 0·6–0·8 length of its stem (equal to its stem in the type female according to Theobald, 1907); base of cell R_2 well proximal to base of cell M_1 in females, level with or slightly proximal to it in males; r-m in line with or its own length distal to i-r, in line with or up to twice its own length distal to base of M_{3+4} . Haltere with mainly dark scaled knob. Male terminalia (Fig. 5) similar to those of *colledgei* and the southern brown form of *stigmaticus* but apparently distinguished by the sternal lobe of the harpago which bears three setae, of which the distal is stout, the middle one slender, and the proximal almost as stout as the distal (only the distal seta is stout in the other species). Edwards (1924) described 6 pairs of leaflets on the phallosome, but the male from Burpengary has about 10 pairs.

P. F. Mattingly has kindly checked the type specimens of *corethroides* and states (personal communication)—“I removed both the male and the female type from their stands and as far as I can see the propleural hair is single in both cases. The haltere seems to be entirely dark in the female but there are some very small pale scales on the under (outer) surface in the male.”

BIOLOGY: Adults of *corethroides* have been reared from the following breeding places: a gum and teatree swamp at Caloundra; a shallow, shaded waterhole at Salisbury, 200 square yards in surface area, with reeds, grasses, water weeds and teatree roots; a large swamp behind the beach just south of Dunwich, with fresh, clear to slightly muddy water, peaty or sandy bottom and few trees, where the larvae were most frequently found in shallow peaty hollows with some moss at edges, floating duck weed, and partly shaded by grass and shrubs, but occurred also in soak holes and muddy foot prints shaded by sedges and ferns 3–4 ft. high, and in water between tussocks. Associated species in the foregoing sites included *Anopheles atratipes*, *A. annulipes*, *Uranotaenia pygmaea*, *Culex* sp. (near *cylindricus* Theo.), *C. postspiraculosus* Lee and *C. pipiens australicus*. Similar sites occur at Fraser Island and in the vicinity of Burpengary where Dr. Bancroft reared his specimens from a soak hole 4 ft. square, dug in a gully in the scrub.

No *corethroides* adults for which particulars are available have been reared from sites other than of the type described and no adults of the southern brown or southern striped forms of *stigmaticus* have been reared from teatree or sedge swamps. The number of specimens is small, but the evidence suggests that *corethroides* is ecologically distinct from the other two forms.

DISTRIBUTION: Fraser Island (16-2-1949, M. J. Mackerras); Caloundra (13-8-1945, F. A. Perkins and J. L. Wassell); Burpengary (Bancroft); Salisbury, a suburb of Brisbane (17-10-1946, J. H. Carney); Dunwich, Stradbroke Island (28-11-1943, E. N. Marks).

ANOPHELES (ANOPHELES) POWELLI Lee.

Anopheles powelli Lee, 1944, Proc. Linn. Soc. N.S.W., 69, 21. Type locality: Adelaide River, Northern Territory. Holotype male and allotype female in C.S.I.R.O. collection, Canberra.

DISTINCTIVE CHARACTERS: Adult with hind-femur entirely dark scaled; sternites uniformly brown; one propleural bristle. Pupa undescribed. Larva uniformly brown; prothoracic seta 1 with about 30 branches arising from a thick flattened shaft; valve seta 13 very long.

DESCRIPTIVE NOTES (based on 9 females from Bamaga, Lockerbie Station and Jacky Jacky): Wing length 2.5-3.0 mm.; scutal bristles all brown; no spiracular bristles; cell R_2 1.0-1.2 times its stem, cell M_1 0.5-0.7 times its stem; knob of halteres dark scaled.

BIOLOGY: Larvae were found in the following small, clear, fresh, flowing streams: at Horn Island in a gravelly, *Pandanus*-fringed creek in eucalypt forest, associated with larvae of *Culex vicinus*; in a creek at Bamaga, along leafy margins in rain forest and semi-shaded edges with trailing grasses and sedges in open forest; associated species in this creek included *Culex halifaxi* and *C. pullus* Theo; at Jacky Jacky in a fairly sunny, sandy creek with grass and fallen leaves along the edges; associated were *Anopheles bancrofti* and *A. novaguinensis* Venhuis; in Cowal Creek village, in a sunny creek, the edges of which had been cleared except for a little dead grass; associated were *A. novaguinensis* and *A. farauti*.

At Bamaga *A. powelli* was also breeding in a large, shaded, leafy, spring-fed rock pool and in shallow leafy seepage pools close to it; associated was *A. novaguinensis*.

Lee (1944) reported engorged specimens of *A. powelli* taken in mosquito nets, but Lee and Woodhill (1944) stated that nothing was known of its biting habits. Six females were taken biting horses near a creek at Bamaga, between 1830 and 1930 hours (after dark, 12-7-1952); only 5 specimens of other species were collected at the same time. Six females were taken biting man at 1700 hours (late afternoon, 16-5-1953) beside a bridge over a creek at Jacky Jacky; the species was breeding in the creek and the adults possibly had been disturbed from resting sites under or near the bridge. One female was taken biting man at 1630 hours in rain forest on Lockerbie Station.

DISTRIBUTION: Horn Island (15-7-1952, M. J. Mackerras and E. N. Marks); Bamaga (12, 13-7-1952, M. J. Mackerras and E. N. Marks; 16-5-1953, R. Domrow; 20-5-1953, E. N. Marks); Cowal Creek (15-5-1953, E. N. Marks); Jacky Jacky (16-5-1953, E. N. Marks and R. V. Miles);

Lockerbie Station, about 8 miles S.W. of Cape York (21-5-1953, E. N. Marks). All the foregoing localities are within a radius of 20 miles from Cape York. This species was recorded from Jacky Jacky by Lee (1944).

SYNOPSIS.

Both sexes, pupa and larva of *Anopheles colledgei* n. sp. are described. It breeds in association with, and is closely related to *Anopheles stigmaticus* Skuse. Four forms of *A. stigmaticus* can be recognised in Queensland. Distinctive characters, notes on biology and distribution records for these and for *Anopheles powelli* Lee are given.

ACKNOWLEDGEMENTS.

I am indebted to Messrs. N. D. Riley and P. F. Mattingly for allowing me to examine the type specimens of *Anopheles corethroides* Theobald in the British Museum (Natural History) collection, and to Mr. G. Mack for the loan of Bancroft's specimens of *A. corethroides* from the Queensland Museum collection.

REFERENCES.

- BANCROFT, T. L., 1908. List of the mosquitoes of Queensland with the original descriptions and notes on the life-history of a number. *Ann. Qd. Mus.*, **8**, 1-64.
- BELKIN, J. N., 1950. A revised nomenclature for the chaetotaxy of the mosquito larva (Diptera: Culicidae). *Amer. Midl. Nat.*, **44**, 678-698.
- 1953. Corrected interpretations of some elements of the abdominal chaetotaxy of the mosquito larva and pupa (Diptera, Culicidae). *Proc. ent. Soc. Wash.*, **55**, 318-324.
- COLLEDGE, W. R., 1901. Notes on a malaria-carrying mosquito (*Anopheles Pictus*). *Proc. Roy. Soc. Qd.*, **16**, 45-58.
- EDWARDS, F. W., 1924. A synopsis of the adult mosquitoes of the Australasian region. *Bull. ent. Res.*, **14**, 351-401.
- 1930. Mosquito notes.—ix. *Bull. ent. Res.*, **21**, 287-306.
- 1932. Diptera. Family Culicidae. *Genera Insect.*, **194**, 1-258.
- KNIGHT, K. L. and MARKS, E. N. 1952. An annotated checklist of the mosquitoes of the subgenus *Finlaya*, genus *Aedes*. *Proc. U.S. nat. Mus.*, **101**, 513-574.
- LEE, D. J., 1944. A new species of the genus *Anopheles* from northern Australia (Diptera, Culicidae). *Proc. Linn. Soc. N.S.W.*, **69**, 21-25.
- LEE, D. J. and WOODHILL, A. R., 1944. The anopheline mosquitoes of the Australasian region. *Monogr. Dep. Zool. Univ. Sydney*, **2**, 1-209.
- MACKERRAS, I. M., 1927. Notes on Australian mosquitoes (Diptera, Culicidae). Part I. The Anophelini of the mainland. *Proc. Linn. Soc. N.S.W.*, **52**, 33-41.
- ROBERTS, F. H. S., 1948. The distribution and seasonal prevalence of anopheline mosquitoes in North Queensland. *Proc. Roy. Soc. Qd.*, **59**, 93-100.
- THEOBALD, F. V., 1907. A monograph of the Culicidae, **4**. London: Brit. Mus. (Nat. Hist.).